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ARMY ENGINEER DISTRICT NORFOLK VA
NATIONAL DAM SAFETY PROGRAM, WINDSOR LAKE DAM (INVENTORY NUMBER--ETC(U)
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ROANOKE RIVER BASIN

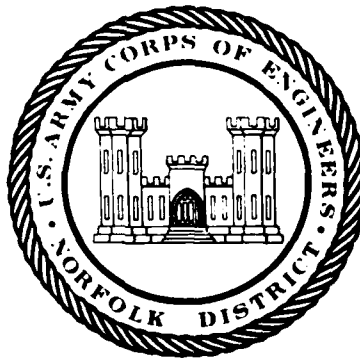
LEVEL II



Name Of Dam: WINDSOR LAKE
Location: CITY OF ROANOKE
Inventory Number: VA 77001

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM

AD A103506



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PREPARED BY

NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

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NOVEMBER 1980

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20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Inspection is to indentify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspection. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

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ROANOKE RIVER BASIN

NAME OF DAM: WINDSOR LAKE
LOCATION: CITY OF ROANOKE, VIRGINIA
INVENTORY NUMBER: VA 77001

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM,

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT OF DAM

Name of Dam: Windsor Lake
State: Virginia
Location: City of Roanoke
USGS Quad Sheet: Salem, Virginia
Stream: Tributary of Barnhardt Creek
Date of Inspection: 9 October 1980

The Windsor Lake Dam is an earthfill structure approximately 380 feet long and 30.3 feet high. The dam is owned and maintained by the Windsor Lake Corporation. The dam is classified as a small size dam with a significant hazard classification. The principal spillway is a 16-inch cast iron pipe drop inlet that connects to an 8-inch cast iron pipe that passes through the dam at low level. The emergency spillway is an open channel V-shaped earthen spillway located on the left abutment. The reservoir is used for recreation.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the 1/2 PMF. The emergency spillway will pass 18 percent of the PMF or 36 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum 0.41 feet, reach an average critical velocity of 3.0 feet per second and flow over the dam for 2.5 hours. Flows overtopping the dam during the SDF are not considered detrimental to the embankment. The spillway is adjudged inadequate, but not seriously inadequate.

The visual inspection revealed no apparent problems and there are no immediate needs for remedial measures. Maintenance is performed by the owners. However, there is no regular maintenance operations program or warning system. It is recommended that a regular maintenance and operations program be instituted with provisions for accurate records of all maintenance performed. It is also recommended that a warning system be established and that the maintenance items listed in Section 7.2 be accomplished as part of the regular maintenance program within the next 12 months.

Submitted By:

Original signed by
JAMES A. WALSH

JAMES A. WALSH, P. E.
Chief, Design Branch

Recommended By

Original signed by
JACK G. STARR

JACK G. STARR
Chief, Engineering Division

Approved:

Original signed by:
Douglas L. Haller

DOUGLAS L. HALLER
Colonel Corps of Engineers
District Engineer

Date: JAN 8 1961



CREST



RESERVOIR AREA

OVERALL VIEWS OF WINDSOR LAKE DAM

9 OCTOBER 1980

SECTION 1

PROJECT INFORMATION

1.1 GENERAL:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (Reference 1, Appendix IV). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Windsor Lake Dam is an earthfill embankment approximately 380 feet long and 30.3 feet high. The crest of the dam is 18 feet wide with a crest elevation of 1085 feet msl. The upstream slope is 1 vertical to 2.0 horizontal (1V:2H) with riprap protection to within one foot of the crest of the dam. The downstream slope is (1V:2H) to the toe of the dam at elevation 1055 ±.

According to a local resident who observed the actual construction, the dam is keyed into the foundation by a core trench. It is unknown if there are any foundation drains. There are no foundation drain outlets.

The principal spillway is a 16-inch cast iron pipe serving as a drop-inlet at elevation 1082.2. A 22-inch corrugated metal pipe and wire mesh have been placed over the intake to function as a trash rack. An 8-inch cast iron pipe connected to the 16-inch CMP at low level in the reservoir passes through the dam and discharges into a small natural stilling basin at the toe of the dam.

The emergency spillway is an open channel earthen V-shaped spillway located in the left abutment with the crest at elevation 1083.6. The spillway will discharge into the downstream channel below the left abutment.

An 8-inch cast iron pipe located about 5 feet upstream of the principal spillway intake functions as a reservoir drain.

1.2.2 Location: Windsor Lake Dam is located about 2 miles southeast of the intersection of State Route 419 and U. S. Route 11 near Salem, Virginia. (See Location Plan, Plate I.)

1.2.3 Size Classification: The dam is classified as a small size structure as defined by Reference 1 of Appendix IV.

1.2.4 Hazard Classification: The dam is located upstream of Spring Valley Lake which has residential homes around the lake and at least 2 homes in the downstream flood plain of Spring Valley Lake. Therefore, a significant hazard classification is given for this structure according to guidelines contained in Section 2.1.2 of Reference 1, Appendix IV. The hazard classification used to categorize dams is a function of location only and has nothing to do with their stability or probability of failure.

1.2.5 Ownership: Windsor Lake Corporation

1.2.6 Purpose: Recreation.

1.2.7 Design and Construction History: The dam was built by Gimbert & Gimbert of Roanoke, Virginia around 1960. It has been reported by a local resident, that the dam was generally constructed to Soil Conservation Service criteria. Riprap was added to the upstream face of the dam in recent years.

1.2.8 Normal Operational Procedures: Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

1.3 Pertinent Data:

1.3.1 Drainage Area: The dam controls a drainage area of 0.15 square miles.

1.3.2 Discharge at Dam Site: The maximum reservoir elevation observed was 1083.6 +, which allowed a trickle of flow through the emergency spillway.

Pool level at crest of dam

emergency spillway. 320 cfs

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

TABLE 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet msl	Reservoir			
		Area, acres	Capacity		Length feet
			Acre, feet	Watershed, inches	
Crest of Dam	1085*	6.0	97	12.1	1600
Emergency Spillway Crest	1083.6	5.7	90	11.3	1550
Principal Spillway Crest	1082.2	5.2	79	9.9	1475
Streambed at Down- stream Toe of Dam	1054.7	--	--	--	--

* Assumed Elevation from Salem, Virginia U. S. Quadrangle Map

SECTION 2

ENGINEERING DATA

2.1 Design: There is no known design information.

2.2 Construction: There are no known construction records. However, Mr. Leo Painter, a local resident, states that the dam was constructed about 1960 by Gimbert and Gimbert Construction Company of Roanoke, Virginia (no longer in business). Mr. Painter was an employee of the Soil Conservation Service (SCS) during that time and observed the construction. He stated that there were several springs both upstream and downstream of the dam site before construction, and that the dam was generally constructed to SCS criteria; i.e., with a core trench keyed into the foundation and the embankment "backfilled with good material". 1/

Mr. Hanes, a representative of the owners present during the inspection, stated that about 3 years ago riprap was placed on the upstream slope and the emergency spillway channel was cut.

2.3 Evaluation: There is insufficient information to evaluate foundations and embankment stability.

1/ Mr. Painter volunteered this information during a telephone conversation with Norfolk District personnel on 22 October 1980.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 9 October 1980 inspection are recorded in Appendix III. At the time of the inspection, the weather was clear and cool. The temperature was 45 - 55°F and the ground conditions were dry. The pool elevation was 1081.5 feet msl, or about 0.7 feet below normal pool elevation. The tailwater was at 1054.9 feet msl. No flow was passing through the principal and emergency spillways. There are no known prior inspection reports.

3.1.2 Embankment: The embankment is in good condition. A sketch showing a plan view and cross section is provided on Plate II, Appendix I. An overall view of the crest is provided at the beginning of the report.

There are no signs of surface cracks, unusual movement, sloughing, misalignment, or riprap failures. However, there are several bare spots located on the crest approximately 50 feet right of the left abutment. Also, a small hole about 8 inches in diameter is located on the upstream face just above the principal spillway outlet pipe. (See Plate II, Appendix I).

A wet area is located along the downstream toe. It extends from the right abutment approximately 30 feet towards the principal spillway outlet pipe. Cattails and reeds are growing in this area. (See Plate II, Appendix I).

A seep is located on the downstream right abutment at elevation 1065.2. Its flow runs down the abutment saturating the toe, and continues downstream. The flow is clear but the rate was not measured. (See Plate II, Appendix I).

A spring is located approximately 10 feet from the toe on the downstream right abutment at elevation 1061.6. Water is flowing from an area about 25 feet wide by 6 feet in height. The flow is clear. Rate of flow was measured far enough downstream to incorporate both the spring flow and the run off from the seep and was 11.8 g.p.m. (See Photos. No. 5 & 6, Appendix II).

Although no flow is passing into the principal spillway, water is trickling from the discharge pipe.

The crest is well vegetated with grass. The upstream face is riprapped to within 1 foot of the crest, this area is well vegetated with grass and small shrubs. The downstream face is well vegetated with grass, ground ivy, shrubs, and small pine and hardwood trees ranging in diameter from 2 to 6 inches. (See Photos. No. 1 and 2, Appendix II and Overall View of Crest at the beginning of report).

Area soils are low plastic silty clays with some fine to medium sand.

Two sanitary sewer manholes, one located on each abutment, are located about 10 feet downstream of the crest. Apparently a pipeline runs through the dam parallel to its longitudinal axis.

3.1.3 Outlet Works: The 16-inch cast iron pipe intake structure is in good condition. The emergency gate valve stem extends from an 8-inch cast iron pipe and appears in good condition. There is no wheel on the valve stem. The gate was operated three years ago to drawdown the reservoir to facilitate placement of riprap on the upstream slope. The discharge pipe passes under the dam and empties at the toe. (See Photo. No. 3, Appendix II). There is no stilling basin.

3.1.4 Emergency Spillway: The emergency spillway is a V-shaped channel cut through natural ground in the left abutment. The approach channel and control section are well vegetated with a grass. (See Photo. No. 4, Appendix II). A wood pile, a canoe, and a picnic table are located in the control section. A floating dock is anchored to the shore in the approach channel. The discharge channel is blocked by trees and shrubs on the downstream left abutment.

3.1.5 Instrumentation: There is no instrumentation on the dam.

3.1.6 Reservoir Area: The reservoir slopes are mild to moderately steep and heavily wooded. There are no signs of reservoir slope failure or shoreline erosion. The inspection team was unable to evaluate reservoir sedimentation. An overall view of the reservoir is provided at the beginning of the report.

3.1.7 Downstream Channel: The downstream channel slopes are moderately steep and heavily wooded. The flood plain is well vegetated with trees and shrubs. A fence crosses the area approximately 30 feet downstream of the principal spillway outlet pipe. A lower reservoir is located downstream of Windsor Dam. Homes are located around the lower lake and downstream of the lower dam (Spring Valley Lake Dam).

3.2 Evaluation: Overall the dam appeared in good condition. The inspection revealed certain preventive maintenance items which should be scheduled as part of an annual maintenance program. These are:

- a. The bare spots on the crest should be regraded and reseeded.
- b. The small hole above the principal spillway outlet pipe should be backfilled with compacted material and seeded.
- c. The wet area along the toe, the spring in downstream right abutment area, and flow from the principal spillway outlet pipe should be monitored for an increase in flow during periodic inspection and after higher pool levels in the reservoir. The seeps should be monitored for increased flow.
- d. The small shrubs on the face of the dam should be cut off at their roots.

e. The trees on the downstream face of the dam should be cut off at their roots. Any trees with diameters larger than 3 inches should have their root systems removed. Subsequent holes should be backfilled with compacted material and seeded.

f. The wood pile, canoe, and picnic table should be removed from the emergency spillway.

g. The trees and shrubs in the discharge channel of the emergency spillway should be cut off at ground level.

h. A staff gage should be installed in the reservoir to extend above the crest of the dam.

i. The trees and shrubs along the toe of the dam should be cut off at ground level annually as a part of the maintenance program to provide access to monitor the seep, the wet area, and the spring in the downstream area.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures: The normal storage pool is elevation 1082.2, which is the crest of the principal spillway. The reservoir provides recreation. Water passes automatically through the principal spillway as the water level rises above the principal spillway crest (elevation 1082.2). Water will pass automatically through the emergency spillway when the water level in the reservoir rises above elevation 1083.6. An 8-inch cast iron pipe located about 5 feet upstream of the principal spillway intake is available for dewatering the reservoir.

4.2 Maintenance: The members of the Windsor Lake Residents Association have the grass mowed, copper sulfate added to the reservoir and other maintenance items performed as needed.

4.3 Warning System: At present time, there is no warning system or emergency operations plan for Windsor Lake Dam.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, the regular maintenance program should be expanded with documentation to include vegetation removal on the embankment and a warning plan should be developed. It is recommended that a formal emergency procedure be prepared and furnished to all operating personnel. This should include:

- a. How to operate the dam during an emergency.
- b. Who to notify, including public officials, in case evacuation from the downstream area is necessary.

SECTION 5

HYDRAULIC/HYDROLOGIC DATA

5.1 Design: None were available.

5.2 Hydrologic Records: None were available.

5.3 Flood Experience: The maximum pool observed was about 1083.6, which allowed a trickle of flow through the emergency spillway.

5.4 Flood Potential: The 100 Year Flood, 1/2 PMF, and PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 2, Appendix IV) and appropriate unit hydrograph, precipitation and storage-outflow data. Clark's Tc and R coefficient for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from U. S. Weather Bureau Publications (References 3 and 4, Appendix IV).

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1.

Water passes automatically through the principal and emergency spillways as the reservoir rises above the spillways crests.

The storage curve was developed based on areas obtained from a U. S. Geological Survey Quadrangle Map. Survey data taken during the inspection was correlated to the Salem, Virginia Quadrangle Map to help develop the area-storage data. Rating curves for the emergency spillway and non-overflow section were developed. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the principal spillway crest (elevation 1082.2). Flow through the principal spillway was neglected in all routings.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 RESERVOIR PERFORMANCE

	Normal	100 Year	1/2 PMF	PMF 2/
Item	Flow	Flood 1/		
Peak flow c.f.s.				
Inflow	1	268	695	1389
Outflow	1	213	679	1358
Maximum elevation				
ft. msl	1082.2	1085.06	1085.41	1085.93
Non-overflow section				
(el 1085)				
Depth of flow, ft		.06	.41	.93
Duration, hrs		.5	2.5	5.3
Velocity, fps 3/		1.2	3.0	4.6
Tailwater elevation				
ft msl	1055+	-	-	-

1/ The 100 Year Flood has one chance in 100 of occurring in any given year.

2/ The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

3/ Critical Velocity

5.7 Reservoir Emptying Potential: An 8-inch cast iron pipe with outlet at elevation 1055 is available for dewatering the reservoir. The low level opening will permit withdrawal of about 9 c.f.s. with the reservoir level at the crest of the principal spillway and essentially dewater the reservoir in less than 7 days. This is equivalent to an approximate drawdown rate of 4.6 feet per day. This is based on the hydraulic height measured from the maximum storage pool at elevation 1082.2 to the outlet pipe elevation divided by the time to dewater the reservoir.

5.8 Evaluation: Based on the size (small) and hazard classification (significant) the recommended Spillway Design Flood is the 100 Year Flood to the 1/2 PMF. Because of the risk involved, the 1/2 PMF has been selected as the SDF. The spillway will pass 18 percent of the PMF or 36 percent of the SDF without overtopping the dam. The SDF will overtop the dam by a maximum 0.41 feet, reach an average critical velocity of 3.0 feet per second and flow over the dam for 2.5 hours.

Conclusions pertain to present day conditions. The effect of future development on the hydrology has not been considered.

SECTION 6

DAM STABILITY

6.1 Foundation and Abutments: There is no information available on the foundation conditions. The dam is located in the eastern margin of the Valley and Ridge physiographic province. The area is characterized by broad, elongated valleys separated by ridges and hills. The Rome Formation overcrops in the vicinity of the dam and is characterized by red, green, gray, purple, and buff shale and silt stone with interbedded light to dark bluish gray limestone and dolomite. Several zones of tectonic breccia occur along the Max Meadows Fault located north of the dam site. Geologic evidence indicates that the Rome Formation has been thrust northwestward by the Max Meadows Fault. The Rome Formation weathers to a reddish-brown soil containing shale chips. In areas where the carbonate beds are thick, weathering results in Karst topography. As noted in the visual inspection, there is a wet spot on the downstream right toe and a seep and a spring on the downstream right abutment. According to a local resident, the dam is keyed into the foundation with a core trench. It is unknown if there are any foundation drains. There are no foundation drain outlets. The predominate foundation materials are relatively impervious, stable, fine grained, alluvial soils.

6.2 Embankments:

6.2.1 Materials: There is no information available on the nature of the embankment materials. The area soils are low plastic silty clays with some fine to medium sand.

6.2.2 Stability: There are no available stability calculations. The dam is 30.3 feet high and 18 feet wide. The slopes are 2.0H:1V. The dam is subject to sudden drawdown because the approximate reservoir drawdown rate of 4.6 feet per day exceeds the critical rate of 0.5 feet per day for earth dams. The existing pool is 0.7 feet below normal pool. The dam has experienced the maximum control storage pool which is at the elevation of the emergency spillway (1.4 feet above normal pool) with no apparent adverse effects.

According to the guidelines presented in Design of Small Dams, U.S. Department of the Interior, Bureau of Reclamation for small homogenous dams, with a stable foundation, subjected to a drawdown and composed of low plastic fines (CL, ML), the recommended slopes are 3.5H:1V upstream and 2.5H:1V downstream. The recommended width is 16 feet. Based on these guidelines, the dam has an adequate width, but inadequate slopes.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to the Recommended Guidelines for Safety Inspection of Dams, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient information to adequately evaluate the stability of the dam. However, visual inspection revealed no apparent instability. Based on the visual inspection the foundation is considered sound. Based on the Bureau of Reclamation guidelines, the slopes are inadequate, but the width is adequate. However, based on the construction history given by a local resident (who was employed by S.C.S. during the time of construction) the dam is well built. Overtopping is not a problem because flows are shallow, last 2.5 hrs., and the velocity is less than 6 fps, the effective eroding velocity for a vegetated earth embankment. A stability analysis is not required because the dam is well constructed and the visual inspection revealed no apparent problems.

SECTION 7

ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The available engineering data is insufficient to evaluate the embankment stability. The visual inspection revealed no findings that proved the dam to be unsound. The dam is maintained by the local home owners association. However, there is no regular maintenance operations program or emergency operations and warning plan. Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the 1/2 PMF. The spillways will pass 18 percent of the PMF or 36 percent of the SDF without overtopping the dam. Flows overtopping the dam during the SDF are not considered detrimental to the embankment. The combined capacity of the spillways is adjudged inadequate but not seriously inadequate. Overall the dam is in good condition and there is no immediate need for remedial measures. A stability check of the dam is not required.

7.2 Recommended Remedial Measures: It is recommended that the regular maintenance operation program be instituted and documented for future reference. A formal emergency procedure should be prepared and furnished to all operating personnel. This should include how to operate the dam during an emergency, and who to notify including public officials, in case evacuation from the downstream area is necessary. Also, the inspection revealed the following maintenance items that should be scheduled by the owner during a regular maintenance period within the next 12 months:

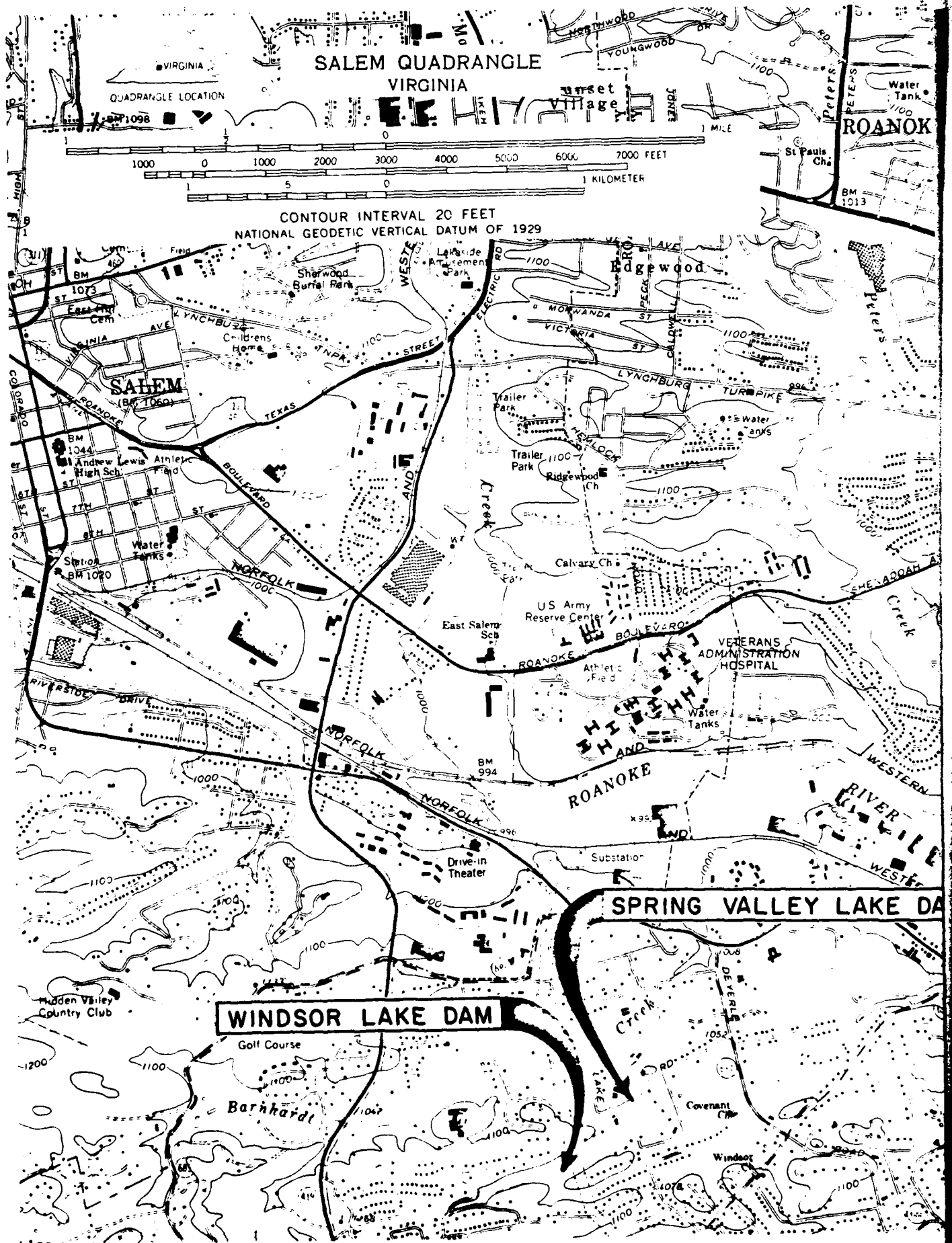
- a. The bare spots on the crest should be regraded and reseeded.
- b. The small hole above the principal spillway outlet pipe should be backfilled with compacted material and seeded.
- c. The wet area along the toe, the spring in downstream right abutment area, and flow from the principal spillway outlet pipe should be monitored for an increase in flow during periodic inspection.
- d. The small shrubs on the face of the dam should be cut off at their roots.
- e. The trees on the downstream face of the dam should be cut off at their roots. Any trees with diameters larger than 3 inches should have their root systems removed. Subsequent holes should be backfilled with compacted material and seeded.
- f. The wood pile, canoe, and picnic table should be removed from the emergency spillway.

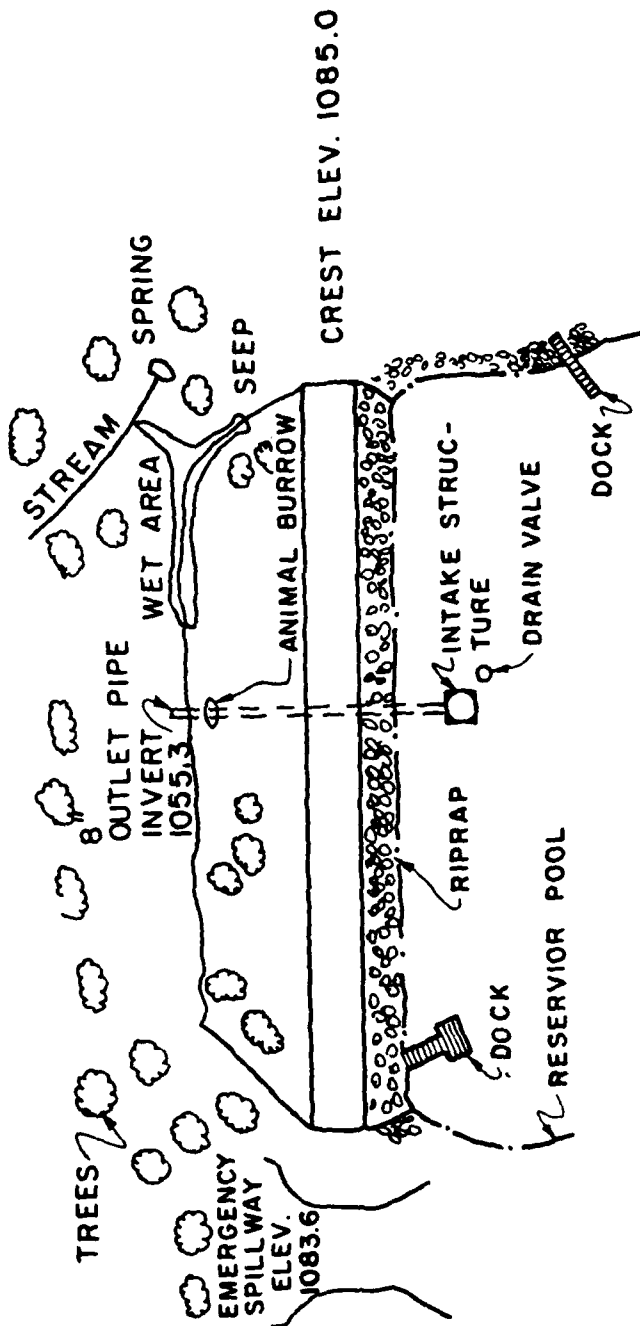
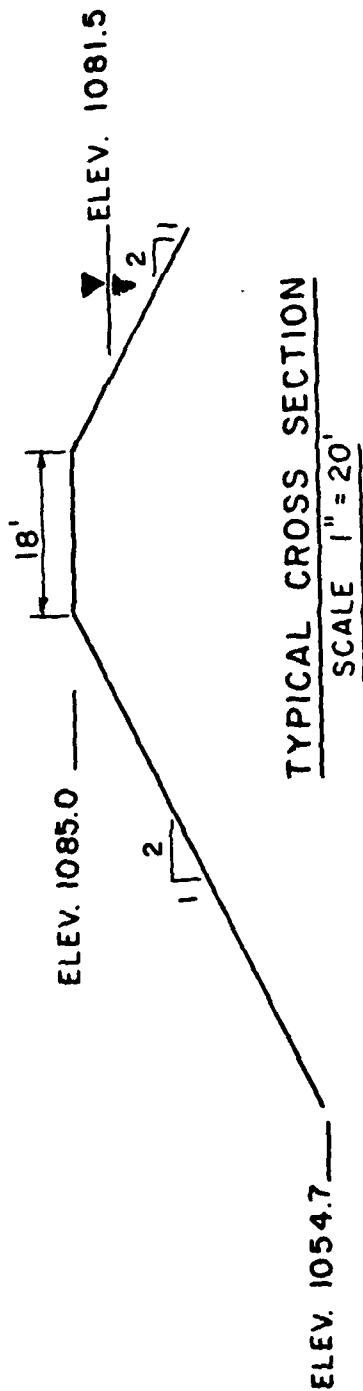
g. The trees and shrubs in the discharge channel of the emergency spillway should be cut off at ground level.

h. A staff gage should be installed in the reservoir to extend above the crest of the dam.

i. The trees and shrubs along the toe of the dam should be cut off at ground level annually as a part of the maintenance program to provide access to monitor the seeps, the wet area, and the spring in the downstream area.

APPENDIX I
MAPS AND DRAWINGS





PLAN VIEW OF THE DAM
NOT TO SCALE

NOTES

1. SKETCH MADE FROM FIELD NOTES.
2. ELEVATION BASED ON TBM ON CREST OF DAM = 1085.0 FEET TAKEN FROM USGS QUADRANGLE SALEM, VA.

WINDSOR DAM
ROANOKE COUNTY
9 OCTOBER 1980
PLATE II

APPENDIX II

PHOTOGRAPHS



PHOTO #1 UPSTREAM FACE



PHOTO #2 DOWNSTREAM FACE



PHOTO # 3 OUTFALL

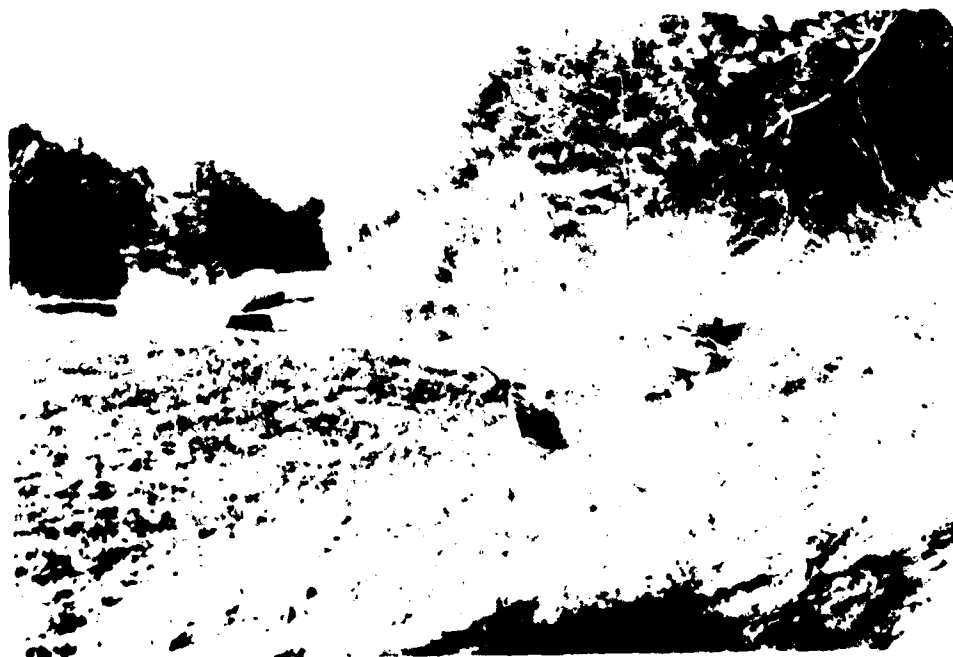
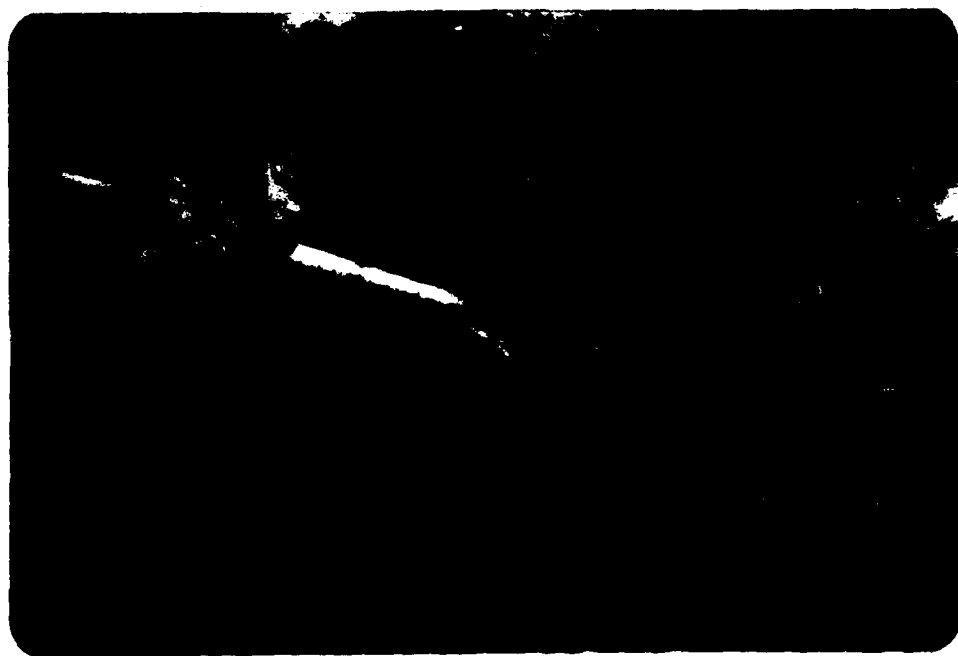


PHOTO # 4 EMERGENCY SPILLWAY



**PHOTO # 5 COMBINED FLOW FROM
SEEPS & SPRINGS FROM RIGHT
SIDE OF D/S VALLEY**



**PHOTO # 6 COMBINED FLOW FROM SEEPS
AND SPRINGS IN DOWNSTREAM
AREA**

APPENDIX III
FIELD OBSERVATIONS

Check List
Visual Inspection
Phase I

Name Dam: Windsor Lake
Coordinates: Lat. 37° 15.4' North
Long. 80° 01.4' West

City: Roanoke

State: Virginia

Date of Inspection: 9 October 1980 Weather: Clear, Cool

Temperature: 45-55° F.

Pool Elevation at Time of Inspection: 1081.5 ft. m.s.l.

Tailwater at Time of Inspection:
1054.9 ft. m.s.l.

Inspection Personnel:

B. Taran, COE
J. Robinson, COE
L. Jones, COE

D. Davis, COE
D. Bushman, SWCB
H. Gildea, SWCB

Dr. O. W. Clifton, President, Homeowners Asso
Mr. C. W. Hanes, Ex-Pres., Homeowners Assoc.

Robinson & Davis Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	There are no surface cracks. Ground conditions are dry.	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	There are no creep, sloughing, or bearing capacity problems.	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Several small bare spots are located on the crest approximately 50 feet right of the left abutment on the crest. A small hole about 8 inches in diameter of unknown depth is located on the downstream face over the outfall pipe about 5 feet upstream of where the pipe exits the face of the dam. Depth of the hole was not measured, estimated 1.5 feet.	The bare spots should be regraded and seeded. The small hole should be back-filled with compacted fill and seeded.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	The crest alignment is straight. There is no noticeable settlement. The conduit alignment appears straight.	None
RIPRAP FAILURES	The full length of the upstream face of the dam is riprapped from approximately 1 foot below the crest to approximately 2 feet below the present water surface. The riprap is in good condition. Several patches of grass are growing out of the riprap.	None
FOUNDATION	There is no noticeable sliding or settlement. The foundation material is generally impervious and appears stable. There are no known foundation drains. There are no outcrops in the area.	None

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	<p>A wet area exist on the downstream toe. The area extends from the right abutment along the toe approximately 30 feet. Cattails and small reeds are growing in this area. A seep is located on the downstream right abutment at elevation 1065.2.* Flow is clear, rate not measured. Flow runs down the abutment saturating toe. A spring is located downstream of the dam approximately 10 feet from the toe on the right abutment at elevation 1061.6*. Water is flowing from an area approximately 25 feet wide by 6 feet in height. Flow is clear. Rate of flow of both the seep and spring was measured approximately 80 feet downstream of the toe and was 11.8 gpm. Although there is no flow into the principal spillway, water is trickling from the discharge pipe.</p>	<p>The wet area, the seep, the spring, and the flow from the discharge pipe should be monitored for an increase in flow during periodic inspections.</p>
DRAINS	There are no known embankment drains.	None
MATERIALS	Area materials are plastic silty clays with some fine to medium sand.	None
VEGETATION	<p>The crest is well vegetated with grass. The upstream face is ripped to within 1 foot of the crest, this area is well vegetated with tall grass and small shrubs. The downstream face is well vegetated with grass, ground ivy, shrubs and scattered pine trees and hardwoods ranging in diameter from 2 to 6 inches.</p>	<p>The small shrubs should be cut off at their roots. The trees should also be cut down at their roots. However, trees having a diameter larger than 3 inches should have their root systems removed. Subsequent holes should be backfilled with compacted material and seeded.</p>

*Datum = Crest of Dam - Elevation 1085.0 feet msl taken from USGS Quadrangle, Salem, Va.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
OTHER	Two sanitary sewer manholes, one located on each abutment are located about 10 feet downstream of the crest. Apparently a pipeline runs through the dam parallel to its longitudinal axis.	None

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	<p>A 16 inch cast iron pipe about 20 feet into the reservoir from the approximate center of the dam acts as a drop inlet. A 22 inch CMP is placed over the crest of the cast iron pipe with a screen welded on the top. The CMP and screen prevents clogging of the intake.</p> <p>A wire connects the trash rack to the draw down pipe about 4 feet away.</p>	None
APPROACH CHANNEL	The reservoir was clear of debris.	The intake should not encounter any debris problems.
DISCHARGE CHANNEL	The cast iron pipe and drawdown pass under the dam and discharge at the toe of the dam.	None
BRIDGE AND PIERS	N/A	
EMERGENCY GATE	The 8 inch cast iron pipe acts as a drop inlet and a drawdown outlet. The drawdown is activated by turning the 2-inch pipe extending above the drop inlet. There is no wheel on the valve stem. The gate was operated three years ago to drawdown the reservoir to facilitate placement of riprap on the upstream slope. A trash rack located on top of the drop inlet prevents debris from clogging the pipe.	None
GATES AND OPERATION EQUIPMENT	N/A	

EMERGENCY SPILLWAY

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONTROL SECTIONS	The spillway is a V shape earthen channel cut into the left abutment. A wood pile, canoe, and picnic table are located in the control section. A good grass cover exists over most of the control section.	The wood pile, canoe and picnic table should be removed to allow free flow should the spillway ever be used.
APPROACH CHANNEL	A mild grassed approach channel with a floating dock anchored to the shore is in good condition.	None
DISCHARGE CHANNEL	The discharge channel is blocked by trees and shrubs on the left abutment.	The trees and shrubs should be removed to allow a free flow should the spillway ever be used.
BRIDGE AND PIERS	N/A	
MISCELLANEOUS	N/A	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATION
MONUMENTATION/SURVEYS	There are no known monuments in the immediate area.	None
OBSERVATION WELLS	There are no observation wells.	None
WEIRS	There are no weirs.	None
PIEZOMETERS	There are no piezometers.	None
STAFFGAGES	There are no staffgages.	A staff gage should be installed in the reservoir to extend above the crest of the dam.

RESERVOIR AREA

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The reservoir slopes are mild to moderately steep with good maintenance and care provided by land owners around the lake. Trees line the perimeter of the lake. No signs of slope failure or shoreline erosion. were observed around the reservoir.	None
SEDIMENTATION	The inspection team was unable to evaluate.	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The downstream channel is very narrow and shallow. The flood plain is well vegetated with trees and shrubs. A fence crosses the area approximately 30 feet downstream of the principal spillway outlet.	A maintenance program should clear the trees and shrubs along the toe annually. This will provide access to monitor the wet area, the seep, and the spring.
SLOPES	The downstream area slopes are moderately steep with a good vegetative cover.	
APPROXIMATE NO. OF HOMES AND POPULATION	A lower reservoir is located downstream of Windsor Lake. Homes are located around the lower lake and some downstream of the lower dam (Spring Valley Lake Dam).	None

APPENDIX IV

REFERENCES

APPENDIX IV

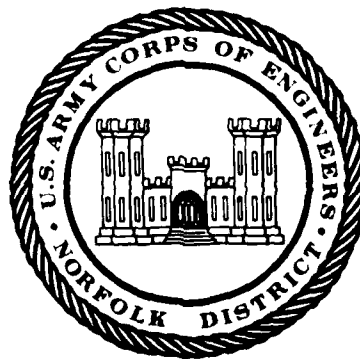
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2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U. S. Army Corps of Engineers, September 1978.)
3. "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," Hydrometeorological Report No. 51, (U. S. Weather Bureau, June 1978).
4. "Rainfall Frequency Atlas of the United States", Technical Paper No. 40, (U.S. Weather Bureau, May 1961).
5. Bureau of Reclamation, U. S. Department of the Interior, Design of Small Dams, A Water Resources Technical Publication, Revised Reprint, 1977.

ROANOKE RIVER BASIN

Name Of Dam: WINDSOR LAKE
Location: CITY OF ROANOKE
Inventory Number: VA 77001

PHASE I INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



**PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510**

NOVEMBER 1980